

IN THE DRAWINGS

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the Examiner has indicated that a sacrificial layer in claim 7 must be shown or the feature(s) canceled from the claim(s).

FIG. 11 is added to show the sacrificial oxide layer 150 as described in the application at page 6, lines 21-30 as amended above, and in claims 7 and 15.

REMARKS

Claim(s) 1-9 are pending in the application.

Claim(s) 1-9 are rejected.

Claims 1 and 3 are amended.

Claim 2 is cancelled in favor of amended claim 1.

Claims 10-15 are added.

No new matter is added.

Claims 1 and 3-15 remain in the case.

Applicant requests reconsideration and allowance of the claims in light of the above amendments and following remarks.

DRAWINGS

The drawings are objected to under 37 CFR 1.83(a).

FIG. 11 is added to overcome the objection. No new matter is added.

Claim Rejections – 35 USC § 103

Claims 1 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fig. 4 of Prior Art, Applicant admitted prior art (AAPA), in view of U.S. Patent 5,940,676 Fazan et al. (“Fazan”).

Applicant respectfully traverses the rejections.

Amended claim 1 now recites:

“forming a cylindrical capacitor lower electrode on the interlayer dielectric layer, the *lower electrode coupled to the contact*;

....

forming a capacitor upper electrode in the shape of a spacer surrounding the sidewall of the ferroelectric layer; and

forming a plate line over a region of the semiconductor substrate where the upper electrode is formed, the plate line *being in electrical contact* with the upper electrode.”
(Emphasis added)

As shown in FIGS. 9 of the present application, the cylindrically shaped capacitor lower electrode 135 is coupled to the contact plug 14 while the spacer shaped upper electrode 143 is in electrical contact with the plane line 147. This is supported in the present

application on page 6, lines 28-29 and is further supported by FIG. 10 which is a top plan view showing an array of cylindrically shaped memory cells protruding upward from the substrate.

In contrast, Fazan does not disclose the above recited limitations of claim 1, e.g., “forming a cylindrical capacitor lower electrode …coupled to the contact,” “forming a spacer-shaped upper electrode …in electrical contact with the plate line,” as recited in claim 1. Fazan’s resulting structure is reverse of the structure illustrated in claim 1 of the present application. In fact, Fazan discloses a spacer shaped electrode 44 electrically *coupled to a capacitor plug* 30, not in contact with the plate line, as recited in claim 1 of the present application. Fazan discloses the forming of what Fazan describes as top electrode spacers in FIG. 8 and at column 7, lines 15-20. In fact, what Fazan describes as “top” electrodes analogize as bottom electrodes if viewed from the perspective of the ferroelectric device described in the present application. Fazan’s “top” electrode spacers are electrically *coupled to the capacitor plug* 30 by highly conductive thin film 50 (as shown in FIGS. 11-12) and the spacers are separated from Fazan’s “bottom” common electrode 35, where common electrode 35 extends throughout and is common to all of the separate spacer electrodes 44.

In fact, the structure disclosed by Fazan is more like the prior art cited in the present application in FIG. 4 where upper electrode 43 (or 35 in Fazan) is a wide-plate type that may produce parasitic capacitance which the present application seeks to reduce. If Fazan’s resulting structure is described using the terminology of the present application, Fazan’s “top” electrodes are similar to the lower electrodes recited in claim 1 of the present application. Fazan’s single, common “bottom” electrode is similar to the wide-plate type of upper electrode disclosed in the present application as the problematic prior art of FIG. 4. Thus, Fazan fails to disclose, “forming a cylindrical capacitor lower electrode …coupled to the contact,” “forming a spacer-shaped upper electrode …in electrical contact with the plate line,” as recited in claim 1.

In addition, the capacitor upper electrode 143 of the present application according to an embodiment surrounds the vertical sidewall of ferroelectric layer 141. In turn, the ferroelectric layer 141 surrounds the cylindrically shaped lower electrode 135.

On the contrary, Fazan also fails to disclose a spacer shaped electrode surrounding a sidewall of a ferroelectric layer. Rather, Fazan discloses a spacer shaped electrode surrounding a filler layer. In particular, as shown in FIG. 13, the dielectric layer 40 in Fazan surrounds the electrode spacer 44. Fazan discloses a forming process of forming a common electrode 35, etching voids 38 in that layer, and then depositing a layer of ferroelectric

material 40 such that the “capacitor area is defined by the *inside* surface area of the *void* 38.” (See FIG. 6, Col. 6, lines 32-39). Fazan then discloses in FIG. 7 and at column 7, lines 6-14, depositing an electrode layer 42 over the dielectric layer 40 by depositing layer 42 *within the void* 38. Fazan then discloses in FIG. 8 and at column 7, lines 15-20, etching layer 42 to form spacers 44 *within the void* 38. A highly conductive thin film 50 is formed (see FIGs. 10-11), thus electrically coupling the spacers 44 to the capacitor plug 30. And, filler layer 52 is “deposited to a thickness sufficient to fill the remaining void in the capacitor structure” as shown in FIG. 13 and disclosed at column 7, lines 52-62. Thus, the process disclosed by Fazan results in a spacer shaped electrode 44 electrically coupled to the capacitor plug 30 and the spacer shaped electrode surrounding a filler layer 52 and not the dielectric layer 40.

Therefore, the combination of the Applicant admitted prior art and Fazan fails to disclose each and every element of independent claim 1. Also, for the reasons discussed above, one skilled in the art would not combine the structure of Fazan with the other cited references.

Accordingly, the rejections do not present a *prima facie* case of obviousness. Claim 1 is believed to be allowable and the applicant respectfully requests its allowance.

Claim 5 depends from claim 1, and for at least the same reasons given for claim 1, claim 5 is believed to be allowable and the applicant respectfully requests allowance of claim 5.

Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fig. 4 of Prior Art, Applicant admitted prior art (AAPA), in view of U.S. Patent 5,940,676, Fazan et al. (“Fazan”), and further in view of U.S. Patent 6,043,526, Ochiai (“Ochiai”).

Applicant respectfully traverses the rejections.

Claim 2 is cancelled in favor of claim 1, as amended hereby.

Claim 3 depends from independent claim 1. The addition of Ochiai fails to overcome the deficiencies of the combination of AAPA and Fazan with respect to independent claim 1. Thus, for at least the same reasons given for independent claim 1, claims 2 and 3 are believed to be allowable and the applicant respectfully requests allowance of these claims.

Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fig. 4 of Prior Art, Applicant admitted prior art (AAPA), in view of U.S. Patent 5,940,676, Fazan et

al. (“Fazan”), and further in view of U.S. Patent 6,043,526, Ochiai (“Ochiai”), and further in view of U.S. Patent 6,100,201, Maejima et al. (“Maejima”).

Applicant respectfully traverses the rejection.

Claim 4 depends from independent claim 1. The addition of Ochiai and Maejima fails to overcome the deficiencies of the combination of AAPA and Fazan with respect to independent claim 1. Thus, for at least the same reasons given for independent claim 1, claim 4 is believed to be allowable and the applicant respectfully requests allowance of this claim.

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fig. 4 of Prior Art, Applicant admitted prior art (AAPA), in view of U.S. Patent 5,940,676, Fazan et al. (“Fazan”), and further in view of U.S. Publication 2001/002395, Lee et al., (“Lee”).

Applicant respectfully traverses the rejection.

Claim 6 depends from independent claim 1. The addition of Lee fails to overcome the deficiencies of the combination of AAPA and Fazan with respect to independent claim 1. Thus, for at least the same reasons given for independent claim 1, claim 6 is believed to be allowable and the applicant respectfully requests allowance of this claim.

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fig. 4 of Prior Art, Applicant admitted prior art (AAPA), in view of U.S. Patent 5,940,676, Fazan et al. (“Fazan”), and further in view of U.S. Patent 6,355,521, Cho (“Cho”).

Applicant respectfully traverses the rejection.

Claim 7 depends from independent claim 1. The addition of Cho fails to overcome the deficiencies of the combination of AAPA and Fazan with respect to independent claim 1. Thus, for at least the same reasons given for independent claim 1, claim 7 is believed to be allowable and the applicant respectfully requests allowance of this claim.

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fig. 4 of Prior Art, Applicant admitted prior art (AAPA), in view of U.S. Patent 5,940,676, Fazan et al. (“Fazan”), and further in view of U.S. Patent 6,355,521, Cho (“Cho”), and further in view of U.S. Publication 2003/0032373 A1, Basol et al., (“Basol.”).

Claim 8 depends from independent claim 1. The addition of Cho and Basol fails to overcome the deficiencies of the combination of AAPA and Fazan with respect to independent claim 1. Thus, for at least the same reasons given for independent claim 1, claim 8 is believed to be allowable and the applicant respectfully requests allowance of this claim.

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fig. 4 of Prior Art, Applicant admitted prior art (AAPA), in view of U.S. Patent 5,940,676, Fazan et al. ("Fazan"), and further in view of U.S. Patent 6,534,809, Moise et al., ("Moise").

Applicant respectfully traverses the rejection.

Claim 9 depends from independent claim 1. The addition of Moise fails to overcome the deficiencies of the combination of AAPA and Fazan with respect to independent claim 1. Thus, for at least the same reasons given for independent claim 1, claim 9 is believed to be allowable and the applicant respectfully requests allowance of this claim.

For the foregoing reasons, reconsideration and allowance of claims 1 and 3-15 of the application as amended is solicited. The Examiner is encouraged to telephone the undersigned at (503) 222-3613 if it appears that an interview would be helpful in advancing the case.

Respectfully submitted,

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Hosoon Lee
Limited Recognition Under 37 CFR § 10.9(b)

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